[Second Edition.]

PATENT SPECIFICATION

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COMPLETE SPECIFICATION.

Improvements in the Manufacture of Coated Flexible Sheet Materials.

We, BRITISH CELANESE LIMITED, a Company incorporated in accordance with the laws of Great Britain, of Celanese House, 22 & 23, Hanover Square, London, W.1, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

This invention relates to coating flexible sheet material with thermoplastic material.

According to the present invention, flexible sheet material is coated with thermoplastic material by a process which comprises passing the sheet material through the nip of a pair of heated calender rolls and around one of them, feeding thermoplastic material into the nip between the sheet material and the second roll, and constraining the plastic material wholly to adhere to and follow the sheet material by means of a doctor blade extending into the nip and pressing against the second roll.

Conveniently also, the thermoplastic material is first brought into sheet form by passage through the nip of a pair of heated calender rolls, the nip being provided with a doctor blade extending therein, whereby the whole of the emerging thermoplastic material is constrained to follow one of the rolls.

The use of doctor blades in this way has several advantages. It allows of dispensing with the expensive apparatus required for accurate control of the temperature of the rolls and permits of the use of steam and other heating media not readily utilisable where close control of temperature is required, particularly where large masses of metals are involved as in heavy calender rolls. Further, it makes possible the use of compositions (for instance those containing oils or a very high proportion of filler, i.e.g a proportion equal to or greater than that of the base material) which have poor cohesion during film formation, although in themselves forming a satisfactory material for the finished article.

The invention includes apparatus for carrying out the above process, comprising a pair of rolls adapted to be heated and co-acting to form a nip, means for feeding flexible sheet material through the nip and around one of the rolls, means for feeding thermoplastic material into the nip between the sheet material and the second roll, and a doctor blade having its operative edge extending into the said nip and pressing against the second roll.

It is important that the doctor blade should be suitably set with regard to the rolls into the nip of which it extends. It should, for instance, be set so that its operative edge is in or near the plane through the axes of the rolls and parallel to those axes and so that the blade points against the direction of travel of the roll against which it presses. Further, if the angle between the face of the blade turned towards the roll against which it presses and a radius of that roll drawn to the line of contact with the blade is much less than 90° the thermoplastic material will not be forced on to the flexible sheet or the diverging roll but will stow under the blade. If the blade employed is bevelled on the face turned towards the plastic material, as is preferably the case, and set so that the above angle much exceeds 100°, the plastic material, especially if it is in the form of a heavy film, will not clear the bevel of the knife, but will bunch under it and fail to pass over to the next roll. The best position of the blade will vary with the thickness of the sheet emerging from the rolls. It has, however, been found that the above angle should, in general, be between 95 and 100°.

The doctor blade preferably has a bevel at the operative side of the face turned towards the plastic material which is long in relation to the thickness of the blade. A blunt, short bevel will obstruct the passage of the plastic material even if the blade is set at the correct angle, while a long easy taper assists in easing it from one roll to the next.

The process is applicable to the coating of flexible sheet materials with compositions comprising various thermoplastic

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Price 1/-

compounds. Thus there may be employed compositions comprising cellulose derivatives, for instance inorganic esters of cellulose, e.g. cellulose nitrate, organic esters of cellulose, e.g. cellulose acetate, cellulose formate, cellulose propionate and cellulose butyrate, and cellulose ethers, e.g. ethyl cellulose, methyl cellulose and benzyl cellulose. Further examples of thermoplastic compounds which can be employed according to the invention are halogenated rubber and vinyl resins.

The thermoplastic compositions employed may comprise modifying agents, e.g. plasticisers, dyes, pigments, lakes, filling materials, fire retardants, resins and oils. By this means it is possible to modify the properties of the finished product, for example so as to impart softness, elasticity, flexibility, hardness, gloss, colour and stability thereto. As examples of plasticisers which can be used in cellulose derivative compositions employed according to the invention, mention may be made of aryl sulphonamides, e.g. para-toluene-ethyl-sulphonamide, alkyl phthalates, e.g. dimethyl phthalate, dialkyl tartrates e.g. dibutyl tartrate, alkoxy-alkyl esters of polybasic organic acids, e.g. di-(ethoxy-ethyl)-phthalate, esters of polybasic organic acids with mono-alkyl ethers of polyhydric alcohols, e.g. the ester of diethylene glycol ethyl ether with phthalic acid, alkyl esters of phosphoric acid, e.g. tri-esters of glycol with phosphoric acid, aryl esters of phosphoric acid, e.g. tricresyl phosphate, mixed alkyl-aryl phosphates, and camphor. These can be employed singly or in combinations of two or more, and in any suitable quantity.

The invention is applicable in the production of composite sheet materials by calendering a sheet of thermoplastic material on to a backing of textile fabric, paper or like sheet base material, and particularly in coating such sheet base materials with thermoplastic compositions which have been reduced to a state of fine subdivision, as in moulding powders. It can, for instance, be used in the production of composite sheet materials by the processes described in British Specifications Nos. 440,767 and 441,622.

In the accompanying drawings there is illustrated an apparatus suitable for use in a process according to the invention in which sheets are formed from powdered thermoplastic material and united with a base fabric.

Figure 1 is a diagrammatic side view showing the arrangement of the doctor blades with regard to the forming sheet of plastic material and the coated material.

Figure 2 is a detailed side view showing a doctor blade and its adjusting means.

Powdered thermoplastic material 12 contained in the hopper 11 is fed to a series of steam-heated calender rolls, 13, 14, 15 and 16, mounted on adjustable bearings so that the distance between the rolls can be accurately adjusted to exert the desired pressure on the forming web of plastic composition.

At each nip of the series of rolls a doctor blade 21, having a bevel which is long in relation to its thickness is mounted with its operative edge extending into the nip and pointing against the roll above the nip and so positioned with regard to the forming web and the rolls forming the nip that it causes the whole of the web emerging from the nip to be carried away by the roll below the nip. The doctor comprises a body member 21 pivotally supported by means of an ear 22 and adjustable by means of set screws 23 and 24 operating through pivoting arms 25 and 26. In the groove 27 in the body 21 is mounted a blade holder 28 fastened to a blade 29, of hard steel, iron or alloy with a relatively sharp edge 33 and a long tapering bevel 32, which is held against the action of the material by a set screw 31 operating in a threaded hole in the body 21. The blade is preferably formed of a metal, or coated with a metal, which does not rust on exposure or tarnish in contact with the plastic material. The bevel 32 on the blade is so shaped and positioned that the forming web emerging from the nip is wholly transferred to the next roll in the series.

When the web is sufficiently condensed and plastic it is pressed on to a fabric base material 18, which is fed through the lower nip roll 16 by the heated roll 19 and which is, if necessary, preheated. The pressure between the rolls 16 and 19 is so regulated that the plastic material is coated on the fabric or, if desired, pressed into or through the fabric. The composite material is then drawn from the device, cooled, and rolled or cut into suitable form. If desired, additional rolls carrying an embossed design can be employed to form a pattern on the hot plastic material coming off the calender roll 19.

If desired, the blade can be supported by a single body member 21 at the centre or two or more such members can be spaced along the blade or the body member can extend from side to side of the calender and be braced against the calender frame and provided with adjusting means co-acting therewith. Again, other means may be provided for the adjustment of the angle of the blade. For instance, the blade may be provided with pivoting points at its ends and with weights or springs. Means other than steam, e.g.

electric resistances and open flames, can be used for heating the calander rolls.

Having now particularly described and ascertained the nature of our said invention and in what manner the same is to be performed, we declare that what we claim is :—

1. A process of coating flexible sheet material with a thermoplastic material, which comprises passing the sheet material through the nip of a pair of heated calender rolls and around one of them, feeding thermoplastic material into the nip between the sheet material and the second roll, and constraining the plastic material wholly to adhere to and follow the sheet material by means of a doctor blade extending into the nip and pressing against the second roll.

2. Process according to Claim 1, wherein the thermoplastic material is first brought into sheet form by passage through the nip of a pair of heated calender rolls, the nip being provided with a doctor blade extending thereinto, whereby the whole of the emerging thermoplastic material is constrained to follow one of the rolls.

3. Process according to Claim 2, wherein a series of rolls co-acting to form a series of nips is employed, each nip being provided with a doctor blade extending thereinto, whereby the thermoplastic material is fed into the first nip and the sheet material is fed into a succeeding nip and united with the thermoplastic material.

4. Process according to any of the preceding Claims, wherein the blade or blades are set at an angle of between 95 and 100° measured between the face of the blade turned towards the roll against which it presses and a radius of that roll drawn to the line of contact with the blade.

5. Process according to any of Claims 1—4, wherein the flexible backing material is a textile fabric.

6. Process according to any of Claims 1—5, wherein the sheet material is coated with a cellulose-ester or -ether thermoplastic material.

7. Processes for coating flexible sheet material, substantially as described.

8. A calender device for coating flexible sheet material with thermoplastic material according to the process of Claim 1, comprising a pair of rolls adapted to be heated and co-acting to form a nip, means for feeding flexible sheet material through the nip and around one of the rolls, means for feeding thermoplastic material into the nip between the sheet material and the second roll, and a doctor blade having its operative edge extending into the said nip and pressing against the second roll.

9. A calender device according to Claim 8, comprising a series of rolls co-acting to form a series of nips, means for feeding thermoplastic material into the first nip, means for feeding flexible sheet material into a succeeding nip, each nip being provided with a doctor blade extending into the nip and pressing against one of the rolls so that the plastic material emerging from each nip is constrained wholly to be carried from nip to nip by the intervening roll and is united with the sheet material at the nip into which the latter is fed.

10. A calender device according to Claim 8 or 9, wherein the blade or blades are set at an angle of between 95 and 100° measured between the face of the blade turned towards the roll against which it presses, and a radius of that roll drawn to the line of contact with the blade.

11. Calender devices for coating flexible sheet material, substantially as described with reference to and as illustrated by the accompanying drawings.

Dated this 12th day of June, 1935.

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1 SHEET

2nd Edition

[This Drawing is a reproduction of the Original on a reduced scale.]

FIG. 1

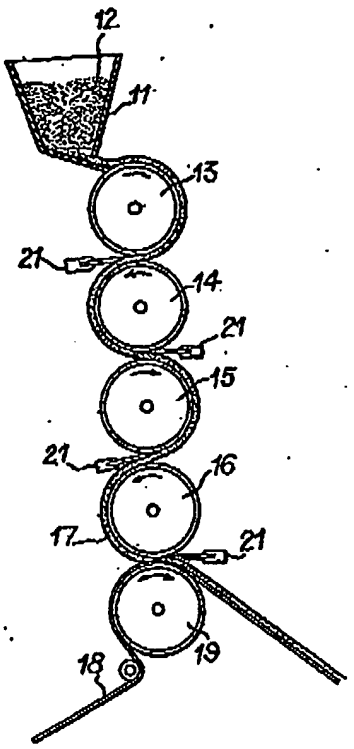
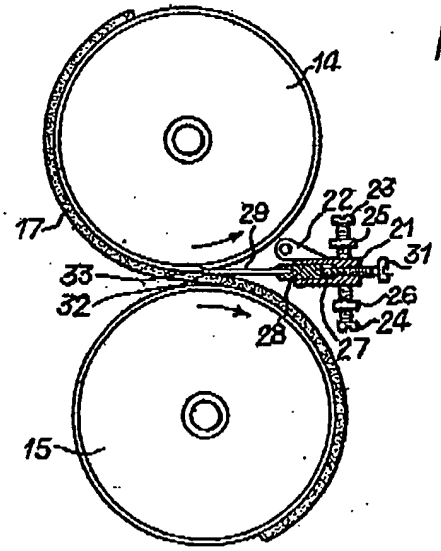


FIG. 2



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